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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/707,984

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David Michael Hoffman

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Philmore H. Colburn II
Cantor Colburn LLP
55 Griffin Road South
Bloomfield, CT 06002

EXAMINER

ROSENBERGER, FREDERICK F

ART UNIT

PAPER NUMBER

2884

DATE MAILED: 11/03/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/707,984

Applicant(s)

HOFFMAN, DAVID MICHAEL

Examiner

Frederick F. Rosenberger

Art Unit

2884

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 August 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3-11,13,15-17 and 19-21 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3-11,13,15-17 and 19-21 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 January 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. Applicant's amendment, filed on 8/24/2005, has been received and entered. Changes have been made to claims 1, 3, 6, 13, and 17. Claims 2, 12, 14, and 18 have been cancelled. Claims 20 and 21 have been added. Accordingly, claims 1, 3-11, 13, 15-17, and 19-21 are now pending in this application.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 1, 3-11, 13, 15-17 and 19-21 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

A broad range or limitation together with a narrow range or limitation that falls within the broad range or limitation (in the same claim) is considered indefinite, since the resulting claim does not clearly set forth the metes and bounds of the patent protection desired. See MPEP § 2173.05(c). Note the explanation given by the Board of Patent Appeals and Interferences in *Ex parte Wu*, 10 USPQ2d 2031, 2033 (Bd. Pat. App. & Inter. 1989), as to where broad language is followed by "such as" and then narrow language. The Board stated that this can render a claim indefinite by raising a question or doubt as to whether the feature introduced by such language is (a) merely exemplary of the remainder of the claim, and therefore not required, or (b) a required feature of the claims. Note also, for example, the decisions of *Ex parte Steigewald*, 131

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USPQ 74 (Bd. App. 1961); *Ex parte Hall*, 83 USPQ 38 (Bd. App. 1948); and *Ex parte Hasche*, 86 USPQ 481 (Bd. App. 1949). In the present instance, claims 1 and 13 recites the broad recitation of a first layer thickness less than 150 μ m (line 11 in claim 1; line 17 in claim 13), and the claim also recites a first layer thickness less than 100 μ m (line 15 in claim 1; line 20 in claim 13) which is the narrower statement of the range/limitation. The balance of the claims is rejected as being dependent upon claims 1 and 13.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 1-9, 11, 13, 15-17, 20, and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chappo et al. (US Patent # 6,510,195) in view of Luhta et al. (Conference paper entitled "Back Illuminated Photodiodes for Multislice CT").

Chappo et al. disclose an ionizing radiation detector comprising:

A first layer **52** (Figure 6) comprising a 1st side and a 2nd side and an array of backlit photodiodes disposed at the 2nd side (bottom of layer **52**);

A second layer **58** (Figure 6) disposed proximate to and opposing the 2nd side of the 1st layer **52**, the 2nd layer comprising thru vias **70** extending from a front side of the 2nd layer to an opposing back side of the 2nd layer;

A scintillator **50** (Figure 6) disposed at the 1st side of the 1st layer **52**, the scintillator comprising a radiation input surface (top of layer **50**) and a radiation output surface (bottom of layer **50**) wherein the scintillation produces light rays exiting at the output surface in response to radiation incident at the input surface, the light rays exiting at the output surface being incident on the 1st side of the 1st layer **52**;

Wherein light rays entering the 1st layer **52** at the 1st side and impinging the backlit photodiodes at the 2nd side result in electrical signals at the thru vias **70** of the 2nd layer **58**, thereby providing electrical output signals from the backlit photodiodes at a distance from the backlit photodiodes.

However, Chappo et al. are silent with regards to the thickness of the 1st layer. It would have been obvious to one of ordinary skill in the art at the time the invention was made to make the thickness of the 1st layer between 25μm and 150μm, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working range involves only routine skill in the art. In re Aller, 105 USPQ 233.

Chappo et al. further disclose that the 1st layer **52** is bonded to the 2nd layer **58** through bumps **56** comprising a soft metal, lead-tin solder, or conductive epoxy (column 6, lines 59-62). Chappo also discloses that the 1st layer is made from silicon (column 6,

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lines 8-14). However, with regards to the 2nd layer, Chappo only discloses that the 2nd layer, as a carrier substrate, carries an electrical circuit for facilitating an electrical signal from the 1st layer and the signal processing electronics (column 6, lines 48-51). There is no specific mention that the 2nd layer comprises silicon. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use silicon for the 2nd layer, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

Chappo et al. are further silent with regards to the cell-to-cell signal crosstalk of the array.

Luhta et al. teach a design for a multilayer CT detector utilizing a back illuminated photodiode array. To reduce crosstalk in the device, cuts were made between the elements of the array (page 239, section 2.3). The resultant photodiode array exhibited a crosstalk of about 1% (page 240, bottom of section 3.2). As is well known in the art, lower crosstalk between pixels results in greater resolution and image quality.

Thus, it would have been obvious for a person having ordinary skill in the art at the time the invention was made to modify Chappo et al. to include a back illuminated photodiode layer with slots to achieve a crosstalk of 1%, as taught by Luhta et al., so as to maximize detector resolution and resultant image quality.

With regards to claim 20, Chappo et al. discloses that the pixel density can range from 1 to 3 pixels per millimeter, thus constituting a pixel pitch of between 333 μ m and 1000 μ m.

With regards to claim 21, Chappo et al. disclose that the back illuminated photodiode array is a single monolithic semiconductor substrate (column 6, lines 6-14). As the photodiode array is formed with conventional semiconductor processing techniques, it would be inherently necessary to have a substrate of uniform thickness. Further, the cuts made into the first layer as proposed by the teachings of Luhta et al., as applicant has not defined in the specifications what constitutes a uniform thickness. A uniform thickness would be interpreted to one of ordinary skill in the art as the bulk substrate thickness without modification.

6. Claims 10 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chappo et al. and Luhta et al., as applied to claims 1 and 13 above, and further in view of Doubrava et al. (US Patent # 6,512,809).

Chappo et al. and Luhta et al. disclose all of the limitations of parent claims 1 and 13, as discussed above. Chappo et al. further disclose a 3rd layer in the form of a printed circuit board **92** (Figure 9) having electrical connections **94** on a first board surface for signal communications with the thru vias **70** at underside contacts **57** (column 10, lines 4-7). Chappo et al. have not addressed the location of additional electrical components on the printed circuit board **92**, although backside mounting of an electrical component to the second layer has been illustrated in Figure 6.

Doubrava et al. teach a multilayer radiation detector for X-ray CT systems. Doubrava et al. also teach that the 1st and 2nd layers can be combined with a 3rd layer as a printed circuit board (column 3, lines 14-16). However, Doubrava et al. additionally

teach that additional electronic components can be mounted to the backside of the printed circuit board to enable compact construction (column 3, lines 16-20).

Thus, it would have been obvious for a person having ordinary skill in the art at the time the invention was made to modify the combination of Chappo et al. and Luhta et al. to have electrical components mounted on the backside of the 3rd layer printed circuit board to enable compact construction, as taught by Doubrava et al.

Response to Arguments

7. Applicant's amendment filed 8/24/2005 has successfully overcome the rejection of claims 1, 9, and 13 under 35 U.S.C. 102(b) over Chappo et al.

8. Applicant's arguments filed 8/24/2005 have been fully considered but they are not persuasive. Applicant has incorporated subject matter from cancelled claims 2 and 12 into claim 1 and from cancelled claims 14 and 18 into claim 13. Applicant alleges that the combination of Chappo et al. and Luhta et al., which was used in the 35 U.S.C. 103(a) rejection of claims 12 and 18, was improper as Luhta et al. teach away from the invention (page 8, 2nd paragraph).

First, applicant alleges that there is no motivation to modify Chappo et al. to obtain the claimed invention (page 8 paragraph 2). In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or

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motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, Luhta et al. teaches improved crosstalk over traditional BIP by using slots cut between adjacent pixels. Improved crosstalk would motivate one of ordinary skill in the art to modify Chappo et al. so as to improve detector sensitivity (see Luhta et al., page 235, section 1.1, paragraph 2).

Second, applicant alleges Luhta et al. teach away from the use of back illuminated photodiodes (BIPs) with thicknesses less than 120 μ m because of increased fragility (page 9, paragraph 1). In the section in Luhta et al. referred to by the applicant, it is noted that the exact thickness for the BIP is a tradeoff between performance and fragility (see Luhta et al., page 236, section 1.2, paragraph 2). While smaller thicknesses may suffer from increased fragility, the resulting BIP would most certainly exhibit better performance. Further, the designation of the thickness choice as tradeoff illustrates that the particular value for the thickness is a judgment necessitated by consideration of factors that one of skill in the art would have been capable of making. While Luhta et al. use 120 μ m for the BIP thickness, never is this referred to as a lower limit for the thickness of the BIP or even an optimum value for the BIP thickness. Thus, in that respect, Luhta et al. does not teach away from using a BIP with a thickness less than 120 μ m.

Third, applicant alleges that Luhta et al. teach away from a uniform thickness because of the inclusion of slots between pixels of the BIP (see Luhta et al., page 9,

paragraph 2). It is noted that said limitation of a uniform thickness only applies to claim 21. Thus, this argument is moot with regards to independent claims 1 and 13. In regards to claim 21, Luhta et al. teach a uniform semiconductor BIP layer that has been cut with slots between adjacent pixels to reduce crosstalk (see Luhta et al., Figure 7). One of ordinary skill in the art would have interpreted uniform thickness to refer to the thickness of the base semiconductor layer and not the variations introduced in the surface topology by the slots or any other micromachining. As applicant has not provided a description of what specifically constitutes a uniform thickness, the broadest reasonable interpretation must be used in evaluating the limitations of the claims. In this regard, the BIP taught by Luhta et al. would satisfy the requirement for a uniform thickness.

Finally, applicant alleges that Luhta et al. do not teach a crosstalk less than 2% for thicknesses less than 100 μ m. Instead, Luhta et al. teach that the crosstalk is less than 2% for a thickness of 120 μ m with slot depths greater than 50 μ m. It is again noted that Luhta et al. teach that smaller BIP thicknesses result in better performance (see Luhta et al., page 236, section 1.2, paragraph 2). Thus, one of ordinary skill in the art would have drawn the conclusion that for a BIP thickness less than 120 μ m with slot depths greater than 50 μ m would result in crosstalk less than 2%.

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Mattson et al. (US Patent # 6,426,991) disclose a back-

illuminated photodiode for CT detectors wherein connection between the photodiodes and signal processing circuitry is made through vias in a second layer (Figure 5).

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Frederick F. Rosenberger whose telephone number is 571-272-6107. The examiner can normally be reached on Monday-Friday 8:00 AM - 5:00 PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Porta can be reached on 571-272-2444. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Frederick F. Rosenberger
Patent Examiner
GAU 2884



DAVID PORTA
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2884